

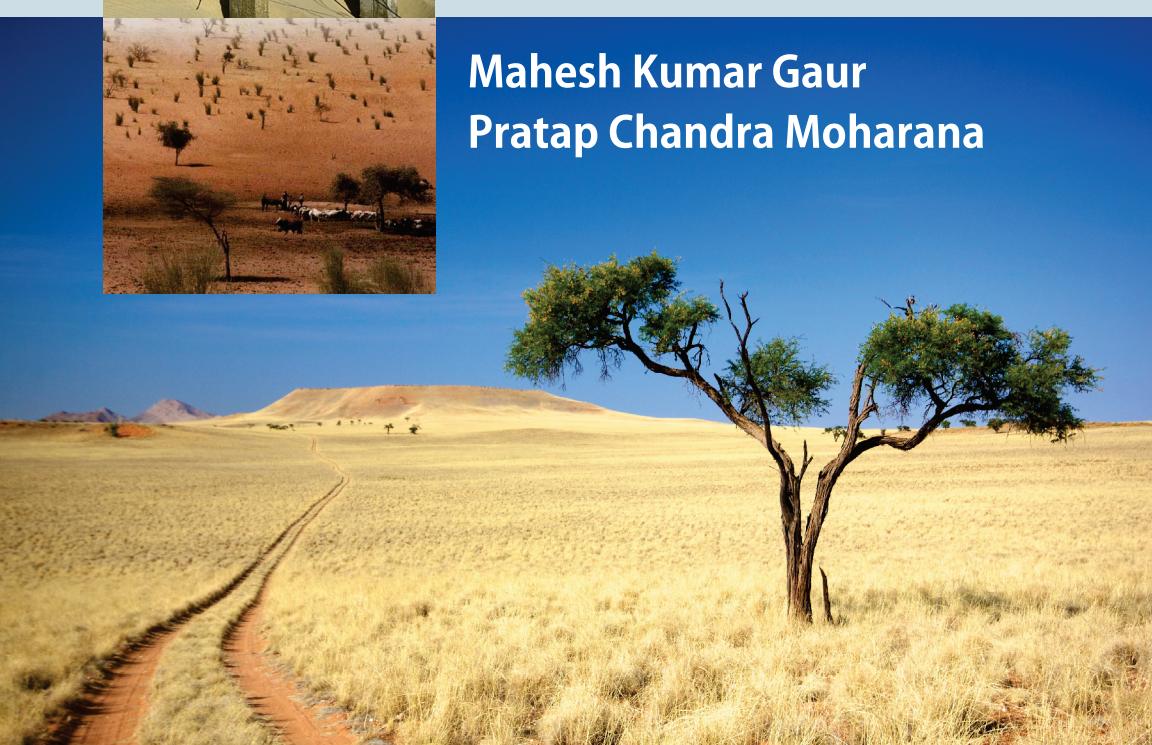
# Environment, People & Development

Experiences from Desert Ecosystems



editors

**Mahesh Kumar Gaur  
Pratap Chandra Moharana**



---

# **Environment, People and Development**

## **Experiences from Desert Ecosystems**

---

**Edited by**

**Mahesh Kumar Gaur**

Senior Scientist – Geography

Cartography & Land Use Section (Div - I)

Central Arid Zone Research Institute (CAZRI/ICAR)

Jodhpur - 342003, Rajasthan, India

**P.C. Moharana**

Principal Scientist

Central Arid Zone Research Institute (CAZRI/ICAR)

Jodhpur - 342003, Rajasthan, India



**NEW INDIA PUBLISHING AGENCY**

New Delhi – 110 034



## NEW INDIA PUBLISHING AGENCY

101, Vikas Surya Plaza, CU Block, LSC Market  
Pitam Pura, New Delhi 110 034, India  
Phone: + 91 (11)27 34 17 17 Fax: + 91(11) 27 34 16 16  
Email: [info@nipabooks.com](mailto:info@nipabooks.com)  
Web: [www.nipabooks.com](http://www.nipabooks.com)

Feedback at [feedbacks@nipabooks.com](mailto:feedbacks@nipabooks.com)

© Editor, 2014

**ISBN : 978-93-81450-79-6**

All rights reserved, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior written permission of the publisher or the copyright holder.

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author/s, editor/s and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The author/s, editor/s and publisher have attempted to trace and acknowledge the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission and acknowledgements to publish in this form have not been taken. If any copyright material has not been acknowledged please write and let us know so we may rectify it, in subsequent reprints.

**Trademark notice:** Presentations, logos (the way they are written/presented) in this book are under the trademarks of the publisher and hence, if copied/resembled the copier will be prosecuted under the law.

Laser Type Setting and Printed at Jai Bharat Printing Press, Delhi-110032

---

# Contents

---

<i>Foreword</i> .....	<i>v</i>
<i>Preface</i> .....	<i>vii</i>
<i>List of Contributors</i> .....	<i>ix</i>
<b>1. Desert, Desertification and Community Resilience .....</b>	<b>1</b>
Introduction .....	1
Manifestations of Desertification .....	2
Desertification : Global Concern .....	4
Areas Vulnerable to Desertification .....	6
Land Quality .....	8
Climate Change and Desertification .....	9
Managing Climate Risk in Rural Kenya .....	12
Conclusion .....	13
 <b>A. Climate Change and Desertification</b>	
<b>2. Desertification Paradigms and Measurements in Indian Context .....</b>	<b>17</b>
Introduction .....	17
Changing Paradigms and their Bearing on Measurement Needs .....	19
Indicators and Benchmarks for Measuring Desertification.	21
Shifts in Measurement Domains of Desertification .....	22
The D-P-S-I-R Concept .....	22
Indicators for Measuring the Implementation of Combating Activities .....	23
Indicators of Desertification : Examples from Arid Lands of India .....	25
State Indicators .....	25
Pressure Indicators .....	30
Socio-economic Indicators .....	32
Desertification Mapping in India .....	34

Harmonization of Heritage Data at National Level .....	35
Systematic Mapping of Desertification based on Remote Sensing .....	36
Systematic Land Degradation Mapping at Country Level ...	37
Looking Beyond Visual Interpretation .....	43
Test Cases of Desertification Monitoring in a Digital Environment .....	45
<i>Conclusion</i> .....	49
<b>3. Desertification in the Eastern Margin of Arid Western Rajasthan - A Geomorphological Assessment .....</b>	<b>57</b>
Introduction .....	57
Climate and Environment .....	59
Physiography and Drainage .....	60
Terrain and Landform Characteristics .....	60
Morphological Characteristics of Landforms .....	62
Present Land Use .....	66
Types, Distribution and Morphology of Degraded Landforms .....	67
Erosion of Sandy Uplands .....	67
Erosion of Rocky Uplands .....	69
Drainage Network and Water Erosion .....	70
<i>Discussion and Conclusion</i> .....	71
<b>4. Climate and Environmental Changes in the Drylands of Central Asia .....</b>	<b>73</b>
Introduction .....	73
Study Area and Historical Trends of Climate Change.....	74
Regional Climate Changes Caused by the Aral Sea Degradation .....	77
Climate Change Impacts and Human Vulnerability .....	80
Human Vulnerability to Climate Change .....	82
<b>5. Survival Strategies Facing Effects of Climate Change in the North Cameroonian Drylands .....</b>	<b>89</b>
Introduction .....	89
From the Recent Quaternary Paleoclimate Oscillations to Present Day Variations in Chad Lake Basin and Its Southern Limit .....	90

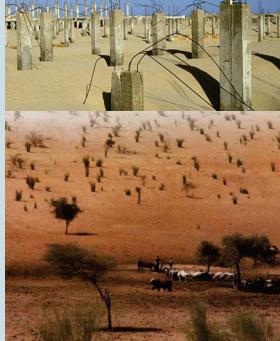
Manifestations and Climate Change Perceptions .....	95
Survival Strategies to Face the Climate Drying .....	98
Conclusion .....	103
<b>6. Climate Change Impacts and Small Scale Farmers : Perceptions and Coping Strategies in Southern Zambia ...</b>	<b>105</b>
Introduction .....	107
Concepts of Climate Change Adaptation, Vulnerability and Mitigation Explained .....	109
<i>Findings and Conclusion</i> .....	110
The Way Forward .....	121
<b>7. Desertification Status in the Democratic Republic of Congo .....</b>	<b>123</b>
Anthropic Activities .....	124
Natural Factors .....	124
Economic Power of Great Arid Zones .....	125
Constraints .....	126
Conclusion .....	126
<b>8. Desertification and Adaptation of Producers' Endogenous Agricultural Practices in Burkina Faso .....</b>	<b>129</b>
Introduction .....	130
Methodology of Research .....	132
Conclusion .....	136
<b>9. Status of Wetland Degradation in Banni and Its Impact on Maldhari Community in Arid Kachchh, Gujarat .....</b>	<b>139</b>
Introduction .....	140
Banni Wetlands .....	140
Material and Methods .....	141
Details of Satellite Data .....	141
Data Used and Interpretation .....	141
Results and Discussion .....	142
Issues in Banni Related to Wetland .....	142
Overgrazing .....	143
Sedimentation .....	143
Irregular Rainfall .....	143
Changes in Species Composition .....	144

Current Scenario .....	144
Problems in the Banni Dhandhs .....	146
Problem Faced by Maldharis .....	146
Conclusion .....	147
Future Steps to Overcome Wetland Conservation .....	148
Acknowledgements .....	148
<b>10. Geo-Environmental Hazards and the Future Planning of the Coastal Area between the Two Nile Branches Rosetta and Damietta for Sustainable Development, North of Nile Delta, Egypt .....</b>	<b>151</b>
Introduction .....	152
Materials and Methods .....	153
Geoenvironmental Hazards .....	154
Erosion and Sea Level Changes .....	154
Sand Dune Encroachment .....	166
Salting of Soils .....	167
Drying Many Parts of El Burullus Lagoon .....	168
Siltation of Damietta Harbour Navigation Canal .....	168
Defective Distribution of Population on the Coastal Plain ...	169
Pollution .....	169
The Negative Effects on the Coastal Protection Projects .....	169
Management of the Coastal Areas .....	170
The Future Planning for the Study Area .....	173
Conclusions .....	180
<b>11. Coastal Sand Dune Encroachment as a Main Reason for Desertification in the Coastal Area Between Gamasa and Burg El-Burullus, North of the Nile Delta, Egypt .....</b>	<b>185</b>
Introduction .....	186
Types of Coastal Sand Dunes .....	187
Sand Dune Encroachment .....	189
Conclusions .....	193
<b>B. Resources, Development and Management</b>	
<b>12. 'ORANS' : The Sacred Groves of Thar Desert, India .....</b>	<b>195</b>
Introduction .....	195

Status of Common Property Resources in India .....	196
Origin of <i>Oran</i> .....	197
<i>Orans</i> Serve as Gene Pool Conservation System .....	199
Declining trend in <i>Orans</i> .....	200
Contribution of Commons in Food Security .....	207
<i>Conclusion</i> .....	208
<b>13. Sustainable Management of Small Scale Irrigation Projects, Case Study : Um Jawaseer Desert Farm Project, Sudan .....</b>	<b>211</b>
Introduction .....	212
Irrigation in Desert Lands .....	214
Planning and Management of Irrigation Projects .....	217
Impact of the Irrigation Project .....	222
Strategies for Economic Sustainability .....	226
<b>14. Indigenous Water Saving Technologies in Arid and Semi-Arid Regions : Examples from Sudan .....</b>	<b>229</b>
Introduction .....	229
Sudan : Geography and Environment .....	230
Drought and Aridity .....	231
Water Saving Categories .....	232
Importance of Indigenous Technologies .....	232
Types of Indigenous Water Saving Technologies .....	233
Examples of IWST in Sudan .....	233
Research and Development .....	240
<b>15. Water Budgeting in Arid Lands .....</b>	<b>243</b>
Why Water Budget? .....	243
How to go About Planning Water Conservation, With Water Budget in Mind? .....	244
Better Water Demand Management Practices .....	245
Better Staff Skills to Educate Residents and Manage Resources .....	246
Reduction of Financial, Institutional and Political Constraints .....	247
Customer and Stakeholder Communication and Water Conservation Program Marketing .....	247

How to go About Designing a Water Budget for an Agency? .....	248
Outcomes of Water Budget .....	249
When to Introduce a Water Budget System .....	250
How to Calculate Water Budget .....	251
A Step-by-Step List to Implementing Water Budget .....	252
<b>16. Issues for Future Urban Planning in Rajasthan .....</b>	<b>257</b>
Introduction .....	257
Urban Growth in Rajasthan .....	258
Changing Structure of the Urban Settlements .....	262
Planning and Administration for Structural Changes .....	263
Livelihood Opportunities as Determinant of Urbanization .....	265
Models of Urban Forms .....	266
Designs of Sustainable Urban Forms .....	267
Suggestions from UN-Habitat .....	269
Need for Policy and Investment Support .....	271
Encouraging Rurbanization : An Alternative to Urban Sprawl .....	276
<b>17. UAE Space Reconnaissance Center as a Valuable Imagery Resource for Monitoring the Environment : An Investigation on Sand Movement .....</b>	<b>279</b>
Introduction .....	280
Role of Remote Sensing in Monitoring Sand Movement and Desertification .....	283
Method of Investigation and Imagery Data Utilized .....	284
<i>Discussion of Results</i> .....	286
<i>Conclusions and Recommendations</i> .....	291
<b>18. The Impact of Land and Water Management on Soil Degradation in Case of Siwa Oasis, Egypt .....</b>	<b>293</b>
Introduction .....	294
Water Resources .....	297
Soils .....	298
Irrigation and Drainage .....	299
Soil Degradation under Poor Drainage Condition .....	301
Conclusion .....	304

<b>19. Economic Evaluation of Precast Concrete Lining in Desert Areas .....</b>	<b>309</b>
Introduction .....	309
Materials and Methods .....	311
Results and Discussions .....	316
Economic Evaluation .....	318
<i>Conclusions</i> .....	318
<b>20. Images are an Outstanding Evidence on Rapid Development : A Perfect Example from United Arab Emirates (UAE) .....</b>	<b>321</b>
Introduction .....	322
Motivation and Aim .....	322
UAE Development Facts .....	323
Methodology and Input Data .....	326
Data Analysis and Results .....	326
<i>Conclusions</i> .....	329
<i>Acknowledgements</i> .....	329
<b>21. Urban Sustainability Perspectives on Changes in Adaptation to Saudi Arabian Desert Environment: The Role of Geospatial Technologies .....</b>	<b>331</b>
Introduction .....	332
Saudi Arabian Desert Environment .....	334
Traditional Adaptation Methods: The Nomads, Agricultural Settlers and Town Dwellers .....	336
Modern Technological Adaptation: Nomads became Settlers and Movement to the Cities .....	338
New Challenges of Modern Saudi Cities and Urban Sustainability .....	339
The Role of Geospatial Techniques in Sustainable Urban Development in Saudi Arabia .....	343
<i>Concluding Remarks</i> .....	345



# Environment, People & Development

**Readership:** The book will be useful to people interested in environmental sciences, geospatial studies, geography, climate change and natural resources

Desert regions are familiar faces in many pages of history of the world. The earliest civilizations and two of the world's major religions were born here.

This publication "Environment, People and Development: Experiences from Desert Ecosystems" highlights some of the basic and technologically refined information from many parts of the Desert ecosystems of the world.

**2014, 368 pages, figures, colour plates, 25cm**

## CONTENTS

- Desert, Desertification and Community Resilience
- Desertification Paradigms and Measurements in Indian Context
- Desertification in the Eastern Margin of Arid Western Rajasthan – A Geomorphological Assessment
- Climate and Environmental Changes in the Drylands of Central Asia
- Survival Strategies Facing Effects of Climate Change in the North Cameroonian Drylands
- Climate Change Impacts and Small Scale Farmers: Perceptions and Coping Strategies in Southern Zambia
- Desertification Status in the Democratic Republic of Congo
- Desertification and Adaptation of Producers' Endogenous Agricultural Practices in Burkina Faso
- Status of Wetland Degradation in Banni and Its Impact on Maldhari Community in Arid Kachchh, Gujarat
- Geo-Environmental Hazards and the Future Planning of the Coastal Area between the Two Nile Branches Rosetta and Damietta for Sustainable Development, North of Nile Delta, Egypt
- Coastal Sand Dune Encroachment as a Main Reason for Desertification in the Coastal Area Between Gamasa and Burg El-Burullus, North of the Nile Delta, Egypt
- 'ORANS': The Sacred Groves of Thar Desert, India
- Sustainable Management of Small Scale Irrigation Projects, Case Study: Um Jawaseer Desert Farm Project, Sudan
- Indigenous Water Saving Technologies in Arid and Semi-Arid Regions: Examples from Sudan
- Water Budgeting in Arid Lands
- Issues for Future Urban Planning in Rajasthan
- UAE Space Reconnaissance Center as a Valuable Imagery Resource for Monitoring the Environment: An Investigation on Sand Movement
- The Impact of Land and Water Management on Soil Degradation in Case of Siwa Oasis, Egypt
- Economic Evaluation of Precast Concrete Lining in Desert Areas
- Images are Outstanding Evidence on Rapid Development: A Perfect Example from United Arab Emirates (UAE)
- Urban Sustainability Perspectives on Changes in Adaptation to Saudi Arabian Desert Environment: The Role of Geospatial Technologies

**Mahesh Kumar Gaur:**Senior Scientist-Geography, Cartography & Land Use Section, Division of Natural Resources and Environment (CAZRI/ICAR), Jodhpur, Rajasthan, India.

**Pratap Chandra Moharana:**Principal Scientist at (CAZRI/ICAR), Jodhpur in Division of Natural Resources and Environment.



## NEW INDIA PUBLISHING AGENCY

101, Vikas Surya Plaza, CU Block, L.S.C. Market  
Pitam Pura, New Delhi-110 034, India  
Tel. : +91(11) 27341717, Fax : +91(11) 27341616  
E-mail : [info@nipabooks.com](mailto:info@nipabooks.com)  
Web : [www.nipabooks.com](http://www.nipabooks.com)

ISBN 9789381450796

